

E-Waste Bin a Solution for E-Waste Collection in India

Abhijeet Singh¹, Shweta Haldhar², Shubham Gairola³, Shubham Gupta⁴, Sikandar Alam⁵

¹Astt. Proff., Department of Civil Engineering, Roorkee Institute of Technology, Roorkee

^{2,4,5}B.tech, Department of Civil Engineering, Graphic Era Hill University, Dehradun

³Lecturer, Department of Civil Engineering, Roorkee Institute of Technology, Roorkee

Abstract – India is the 5th largest producer of the E-waste followed by USA, China, Japan and Germany and is growing annually with the rate of 20%. After conducting a local survey we came to know that 82% of total E-waste produced is because of personal devices like abandoned computers, laptops, mobile phones, etc. There is a lack of knowledge amongst Indian population about the proper disposal of E-waste, its ill effects on human and environment. As a result of which people dump their E-waste with normal waste, that further reaches the dumping grounds where it goes through the process of decomposition in which it releases toxic acids and gases hence affecting both human and the environment. To solve this issue our team developed a prototype machine which will be used for the collection of E-waste which we named '**E-waste bin**'. This bin will be placed at various locations in a city or village just like ATM machines and will serve as a conventional way for the collection of E-waste. In return of deposition of E-waste in this bin the user will get reward points which will be worthwhile for the depositor. The main problem of E-waste i.e. its collection can be solved by this bin which will not only aware people but also save the environment from rising problem.

INTRODUCTION

The problem of E-Waste in India is on the verge as India produced 3 million tons of E-waste by the end of 2018 at a compound annual growth of 20% (according to a joint study on Electricals and Electronics Manufacturing in India conducted by ASSOCHAM-NEC) and unfortunately only 1%-2% of the total E-waste is treated properly which is due to the lack of collection. To understand the present scenario we conducted a local survey from where we came to know that waste collection is done by Municipal Waste Collection Van or Truck from houses. Since there is lack of knowledge about the waste and its category among the households they dump all the waste collectively that consists of organic waste, inorganic waste and E-Waste. Further recycling of this waste is done informally by unauthorized sector insecurely which is not only hazardous for the health of humans and animals but also for the environment. After analyzing problems regarding E-Waste management we realized that the main problem of its management lies in its collection. In this paper it is discussed that how to solve the problem of collection of the waste so that further it can be easily treated in E-Waste Plants.

E-Waste generally contains Printed Circuit Boards (PCB) which contains Toxic metals, wires covered in rubber and other inorganic matter, screens/displays/bulbs/lights that contains toxic fluids and gases and when not treated properly directly or indirectly affect Environment and human health. Following areas in improper E-Waste management are problematic.

1. Arsenic –

It can be found in various components of E-waste like Circuit boards, LED Display, Semiconductors, computer chips, etc. When not treated properly arsenic can percolate into the soil from dumping ground and reach the ground water table and can be absorbed by the plants which ultimately enter the system of humans or other animals. It can cause skin diseases and can reduce nerve conduction velocity. If consumed in large quantity it can cause lung cancer. When mixed with water it affects the pH and affects the aquatic life and other ecosystem.

2. Lead –

Lead is found in almost every E-waste from old cathode ray tube monitors (CRT) to small devices containing soldering. Lead is one of the most poisonous metals which can affects kidney, reproductive system, nerve connections and also causes disorders to blood and brain and if consumed in large quantity it can be fatal.

3. Barium –

Barium is also found in circuit boards or printed circuit boards and is dangerous for environment and human as when consumed it affect the heart muscles and can be the reason for premature death because of heart attack.

4. Chromium –

Chromium is used to coat different electronic component to protect it from rusting and it can also be found in data tapes, floppy disks and etc. when enters in system of human or animal it can cause asthmatic bronchitis, damages liver & lungs and can cause lung cancer.

5. Mercury –

Mercury can be found in fluorescent tubes or bulbs, batteries, old computers, etc. when E-waste containing mercury is dumped in landfill it can get absorbed by land and ground water or mixes with wind after evaporation. When consumed through plants or inhaled can cause mercury poisoning which

directly affects central nervous system, kidney and immune system.

6. Chlorofluorocarbon (CFC) -

CFC is found generally in refrigerator, air conditioners and other cooling electronic devices. It affects ozone layer present in atmosphere because of which ultraviolet rays of sun enters the atmosphere which when humans comes in contact with can cause skin diseases as well as skin cancer.

7. Polychlorinated Biphenyl -

Polychlorinated Biphenyl is widely used as coolant in various cooling devices and its may get mixed with ground water table through dumping grounds and when comes in contact with human or animals it can cause cancer and can affect nervous system, reproductive disorder, immune system and endocrine system.

8. Dioxin and Furans -

These are released from open burning of wires, plastics and etc. it get mixed with the wind. These components did not brakes or decomposes to simpler units and they remains in environment for the long time. These are highly toxic for animals and human, they can cause mutation in fetus and can reduce reproduction and growth rate.

9. Polyvinyl Chloride (PVC) -

PVC is the most commonly used plastic which contains 56% chlorine and it is used to make the casing or body of various electronic devices. When it is burned it releases various toxic gases and acids like hydrogen chloride which affects respiratory system and it releases carcinogens chemicals that cause cancer.

10. Cadmium -

It is generally found in nickel-cadmium batteries, it got into the environment by dismantling the cadmium containing products like batteries, infrared detectors and etc. when consumed it can cause irritation in stomach which can cause vomiting diarrhea. It softens the bones and can cause severe pain in joints and spine.

11. Brominated Flame-retarder -

It is found in most electronic devices, it is very toxic and difficult to breakdown in simpler units. It affects immune system and reproductive system when enters the system.

SOLUTIONS AND SUGGESTIONS-

After concerning above mentioned problems regarding E-waste we designed a machine that will solve the problem of collection providing people a correct place to throw E-waste that they generate.



Fig. 1 - E-waste bin

This machine contains -

- i. A collection bin where all the E-waste get collected for further treatment.
- ii. L.C.D. where instructions displays.
- iii. Finger Print Scanner with the help of which it recognizes or enroll new individual.
- iv. Servo motors
- v. Shutters
- vi. Three Switches
- vii. Ardiium microprocessor

WORKING OF E-WASTE BIN -

A computer that will be used for preparing the database will be connected to the machine and connecting the database with a server. After making all the connections it is ready to use and the message "E-waste bin ready" will be displayed on the screen.



Fig. 2 - Starting of E-waste bin

To use this machine, one should first enroll himself that will be done by C programming which will add the person to the database. This database is created using MS Excel sheet that

contains Name of the individual, Finger Print, points rewarded to the individual and time of deposit.

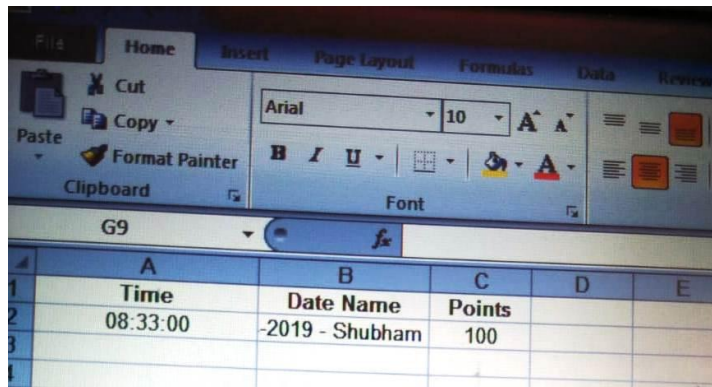


Fig. 3 – Database Entry in Ms Excel

When enrollment is done L.C.D. will display 'WELCOME' along with the name of the individual. After this a message will display which will say 1.Small waste 2.Big waste.



Fig. 4 – E-waste category asking message

As name suggests the Small waste and Big waste refers to the size of the E-waste i.e. batteries, printed circuit boards and etc comes in the category of Small Waste and I-pad, remote and tab etc. comes in the category of Big Waste.



Fig. 5 – Switches on the machine

As it can be seen in Fig. 5 the machine contains three Switches where Switch 1 is for the selection of Small Waste and Switch 2 is for the selection of Big Waste. So if individual wishes to deposit or dump big waste then he just have to press Switch 2 and a message will display on the L.C.D. "I-pad, watch, remote, etc." and the motor connected to the shutter meant to deposit big E-waste will open the shutter.



(a)



(b)

Fig. 6 - (a) message for switch 2 (b) Big E-waste shutter After this one can deposit the waste and as soon as the waste is deposited, sensor detects and identifies the waste and will reward the point to the depositor according to the value or type of the waste.



Fig. 7 – points given

These points will be added to the depositor's database. After this depositor just have to press switch 3 and this will activate exit command and machine will return to the home screen. If the individual wishes to deposit more waste he just have to scan his finger print and the points of his next

deposit will be added to the previous reward points. According to the company/organization/government that will use this E-waste bin can set the parameters and rewards that will be given to the depositors according to their points. For example if government wants to use this so it can give relaxation in electricity bill according to the points depositors has in their account.

A city should have various places where this E-waste bin should need to be installed just like ATMs. It will aware public about correct disposal of E-waste by providing them with an appropriate place to dump their E-waste. Big cities like Bengaluru, Mumbai, New Delhi, Chennai etc. should have large number of E-Waste Bins as these are one of the largest E-waste producing cities of India. This will greatly help India to fight against the problem of E-waste collection, and when collection of E-waste will become easier it will become easy to treat and recycle them properly in the dedicated E-waste plant like 'NaMo E Waste Management Ltd' and many others. If E-waste is properly recycled and treated the above mentioned problems related to improper disposal of E-waste will be solved as the metals and other recycled materials from the E-waste can be further used for other purposes for e.g. the Aluminum recycled from the E-waste can be used by car manufacturing companies to make chaises or body of the vehicles.

CONCLUSION -

People are unaware of the effects of improper disposal of E-waste, because of which they throw their E-waste with common waste. As a result of which E-waste reaches the dumping ground where it undergoes through the process of decomposition and other chemical changes resulting in the emission of toxic acids and gases that are harmful for the health of Environment and human. With the help of this E-waste bin people will understand the importance of correct disposal of E-waste and for doing so they get reward points which will serve them as profits. This will serve as the solution for problem regarding collection of E-waste. Government has various policies where it punishes public through fines for not disposing their E-waste properly but even after this the problem remains the same. This is a known fact that people do work willingly when they get profited or benefits for same. Our machine works on this psychology only which gives reward point to the people for depositing E-waste and ultimately these points will help them directly or indirectly in daily life. If E-waste bin is installed in various places in cities it surely will contribute to the E-waste collection in an accessible manner.

REFERENCES -

1. "The Complete Technology Book on E-Waste Recycling" by NPCS Board of Consultants and Engineers
2. "Electronic Waste Management" by Roy M Harrison, R E Hester

BIBLOGRAPHIES -



Asst. Prof. Abhijeet Singh is Working as a faculty in Civil Engineering Department in RIT, Roorkee. His specialization is in Soil Mechanics and Foundation Engineering.



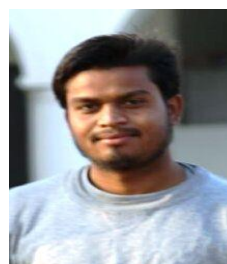
Er. Shweta Haldhar has specialization in Strength of material and Fluid Mechanics



Lecturer Shubham Gairola is working as a faculty in Civil Engineering Department in RIT, Roorkee. His specialization is in Concrete Engineering.



Er. Shubham Gupta is working as a trainee site engineer under p.w.d, Rishikesh division. He specialises in estimation and costing.



Er. Sikandar Alam has specialization is in Building materials and concrete engineering